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(51) INT CL<sup>6</sup>

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H4L LDSU

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(54) Abstract Title

**Selection of an access channel**

(57) A channel of a radio communication base station is allocated as a broadcast channel and is used to transmit information about the current availability of other channels. Mobile stations receiving the channel information and wishing to access the base station attempt to do so on the channels which are believed to be unoccupied. In the event that a second mobile station simultaneously attempts access via the same channel, another channel is selected and the attempt repeated. Communication commences on the selected channel after an access approval signal is received from the base station. The mobile station may select a different access channel if an approval signal is not received within a predetermined period of time.

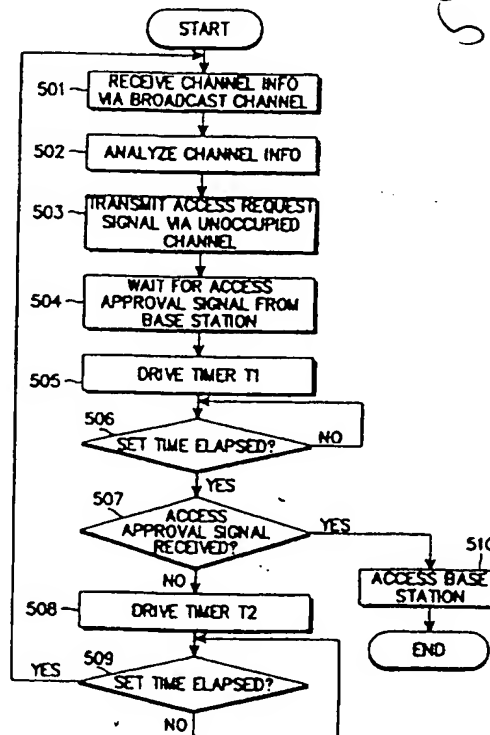


FIG. 5

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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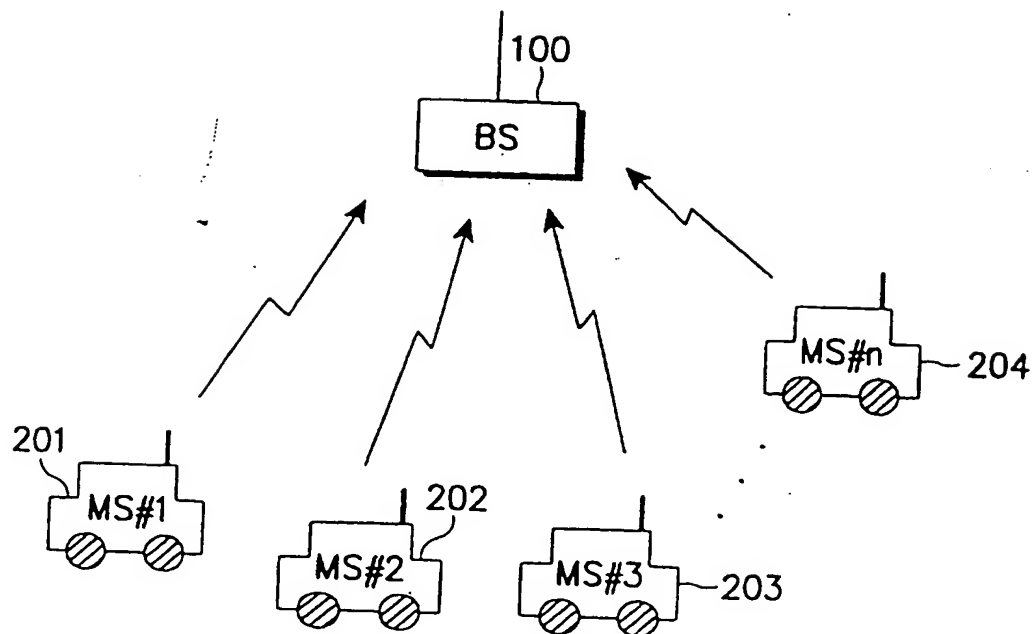


FIG. 1

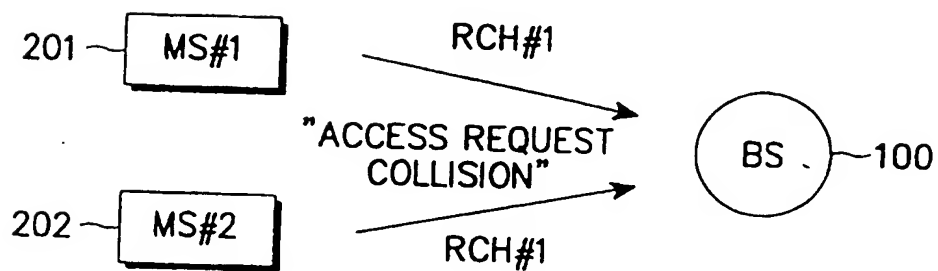


FIG. 2

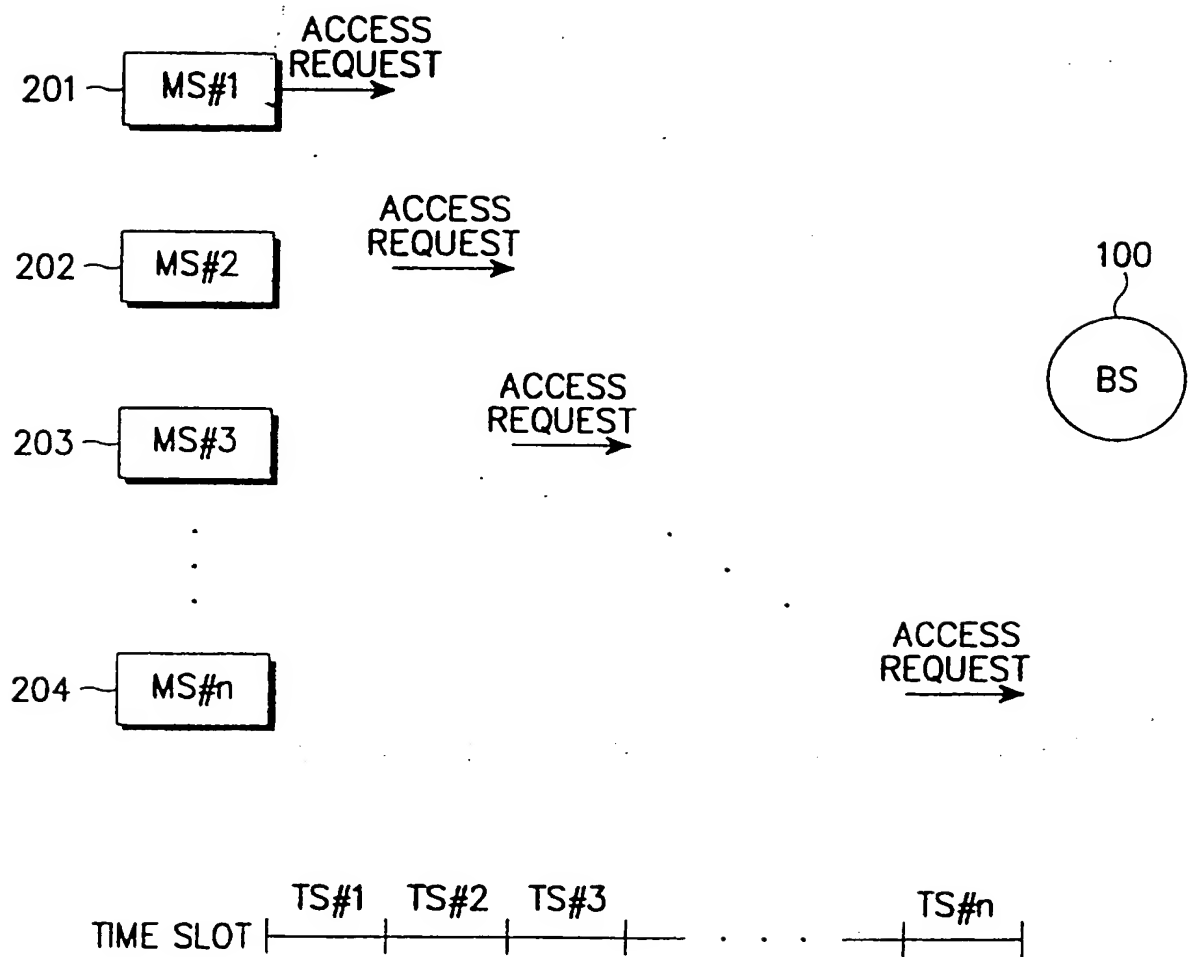
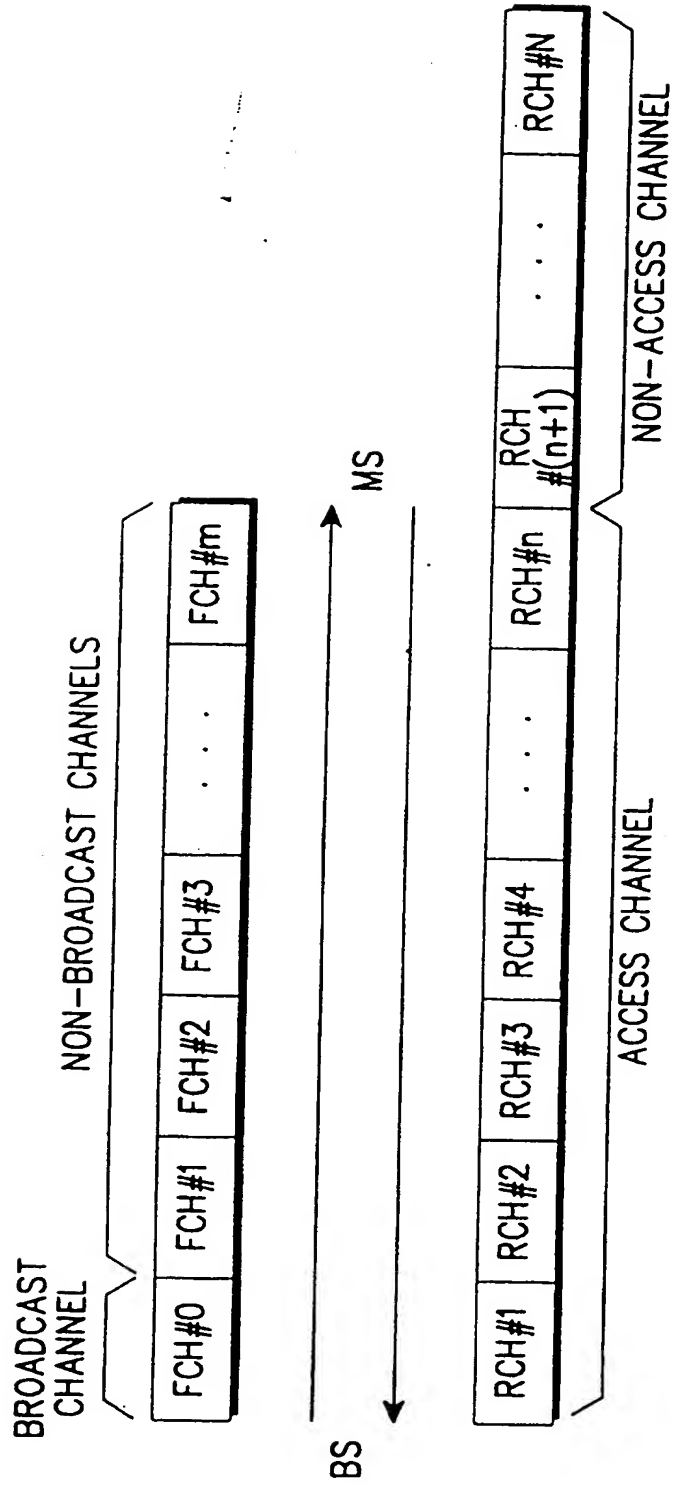


FIG. 3



FCH : FORWARD LINK CHANNEL  
 RCH : REVERSE LINK CHANNEL

FIG. 4

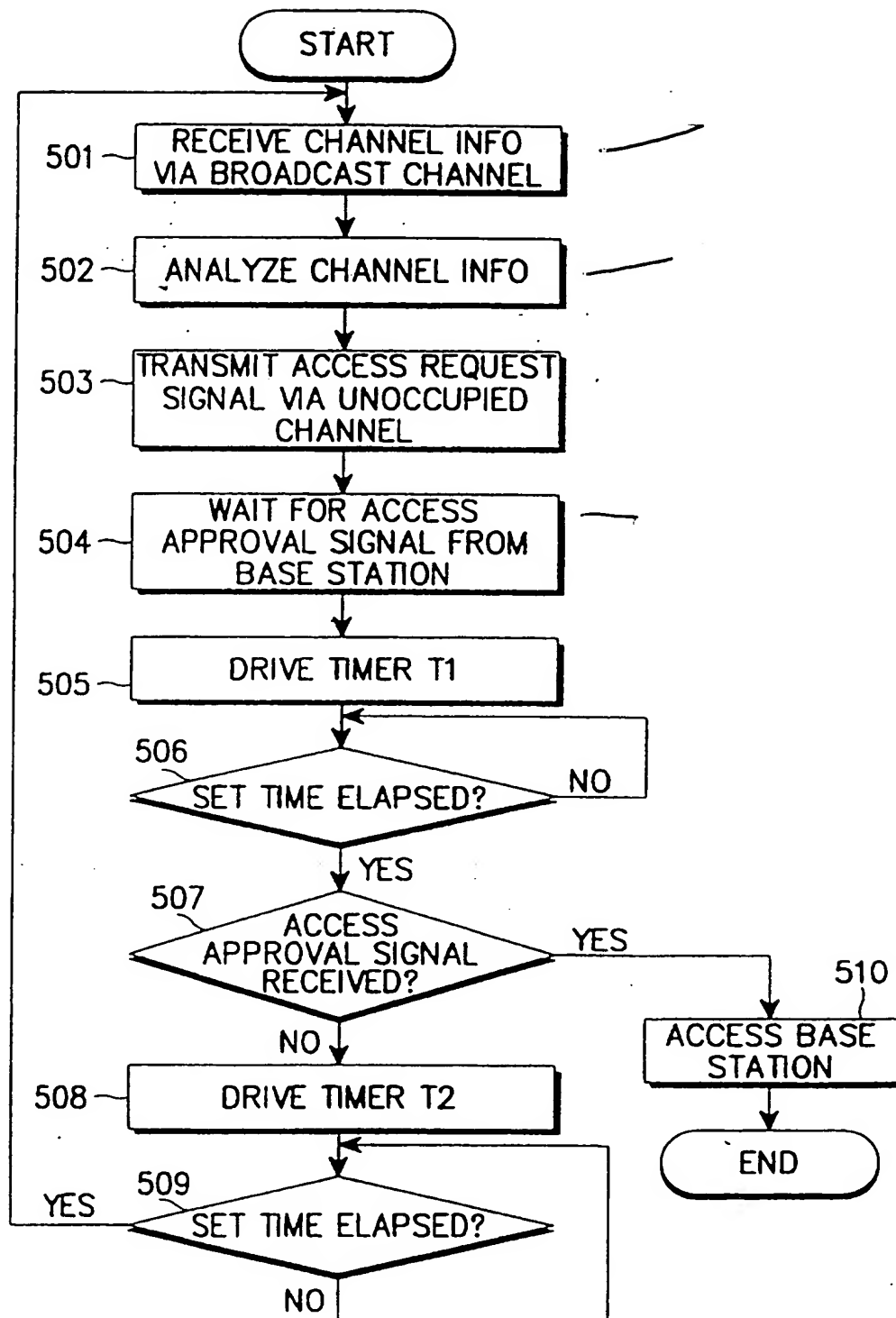


FIG. 5

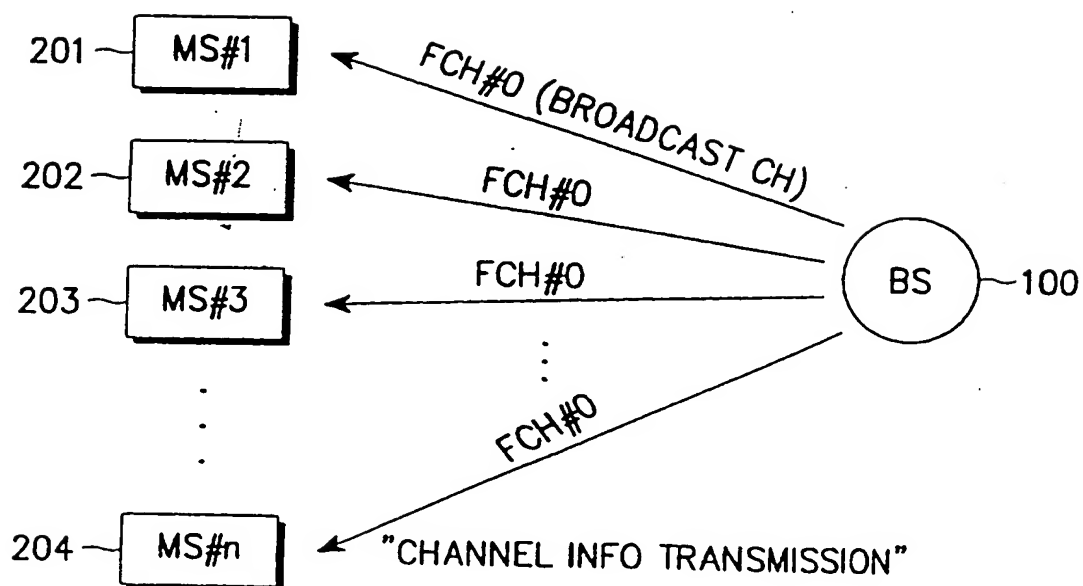


FIG. 6

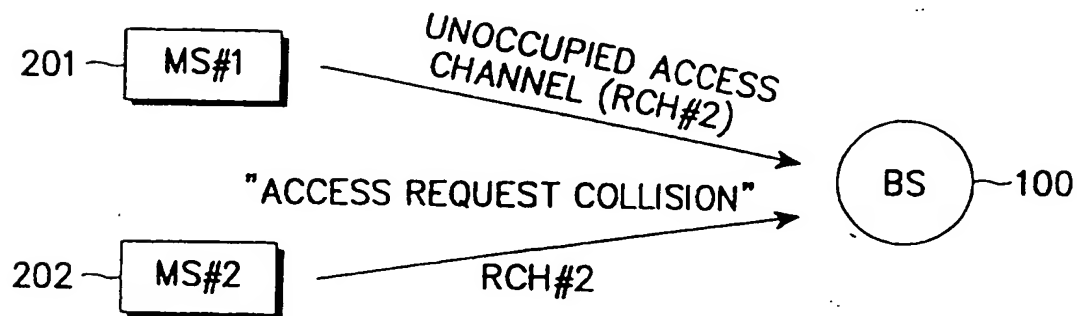


FIG. 7

COMMUNICATION METHOD AND APPARATUS

The present invention relates to a communication method and apparatus for connecting mobile stations to a base station in a radio communication system, and more particularly, to a method for reducing the access time required for a mobile station to access a base station, and preventing collision between multiple access requests made via the same access channel.

Generally, as shown in figure 1, a plurality of mobile stations (MSs) 201-204 are in wirelessly communication with a single base station (BS) 100 in a radio communication system. Although such mobile stations can be applied to various fields, figure 1 shows an example where the mobile stations 201-204 are mounted on respective vehicles.

To accomplish a communication between the base station and the mobile stations mounted on the vehicle, an access operation (i.e., an access request by the mobile station and an access approval by the base station) via a specified access channel has to be performed first. The mobile station transmits an access request signal to the base station through one of the plurality of access channels to communicate with the base station. If an or a requested access request channel is not currently occupied the mobile station can communicate with the base station via this access channel. However, if the access requested channel is already occupied, or if, as shown in figure 2, two different

mobile stations 201 and 202 make simultaneous access requests on the same access channel RCH#1, a collision occurs between the access requests so that the mobile stations fail to access the base station. In a such case, the mobile stations should try to access the base station at a later stage.

Referring to figure 3, another known method allocates time slots TS#1-TS#n to the mobile stations MS#1-MS#n, respectively, to prevent possible collision between the mobile stations during access requests. However, since the mobile stations can make an access request only during allocated time slots there will be a long access time for the mobile stations to access the base station. For example, even in the situation where the second mobile station 202 is not currently making an access request, the third mobile station 203 cannot use the time slot TS#2, and can make an access request only during the time slot TS#3 allocated thereto after the passage of the time slot TS#2.

Accordingly, a first aspect of the present invention provides a method for connecting a mobile station of a plurality of mobile stations to a base station in a radio communication system having a plurality of forward link and reverse link access channels, the method comprising the steps of: allocating, at said base station, one of the forward link channels for a broadcast channel and transmitting channel information about the availability of the reverse link access channels to the mobile stations via the forward link broadcast channel; transmitting an access request signal to the base station from the mobile



stations via a reverse link access channel currently that is unoccupied based on the channel information received via the forward link broadcast channel; and allowing the mobile stations to access the base station via the currently unoccupied channel.

A second aspect of the present invention provides a method for connecting a mobile station to base stations in a radio communication system, comprising the steps of: (a) allocating, at the base station, one of plurality of forward link channels as a broadcast channel and transmitting channel information about the current availability of reverse link access channels to the mobile station via the broadcast channel; (b) analyzing at the mobile station, the channel information and transmitting an access request signal to said base station via one of the unoccupied reverse link channels; (c) determining whether a collision has occurred between the access request of the mobile station and an access request of another mobile station on the unoccupied reverse link access channel; (d) transmitting, from the base station an access approval signal to the mobile station when it has been determined that a collision has not occurred between the access requests; (e) allowing the mobile station to start communication with the base station upon receipt of the access approval signal; and (f) upon failure to receive the access approval signal from the base station, returning to step (b) to transmit an access request signal to the base station from the mobile station via another unoccupied reverse link access channel.

An embodiment provides a method wherein the mobile stations comprises a timer and the mobile station returns to step (b), when the access approval signal has not been received after a predetermined time has elapsed since performing said step (b).

A third aspect of the present invention provides apparatus for connecting a mobile station of a plurality of mobile stations to a base station in a radio communication system having a plurality of forward link and reverse link access channels, the apparatus comprising: means for allocating, at said base station, one of the forward link channels for a broadcast channel and transmitting channel information about the availability of the reverse link access channels to the mobile stations via the forward link broadcast channel; means for transmitting an access request signal to the base station from the mobile stations via a reverse link access channel currently that is unoccupied based on the channel information received via the forward link broadcast channel; and means for allowing the mobile stations to access the base station via the currently unoccupied channel.

A fourth aspect of the present invention provides apparatus connecting a mobile station to base stations in a radio communication system, the apparatus comprising: means for allocating, at the base station, one of plurality of forward link channels as a broadcast channel and transmitting channel information about the current availability of reverse link

access channels to the mobile station via the broadcast channel; means for analyzing at the mobile station, the channel information and transmitting an access request signal to said base station via one of the unoccupied reverse link channels; means for determining whether a collision has occurred between the access request of the mobile station and an access request of another mobile station on the unoccupied reverse link access channel; means for transmitting, from the base station an access approval signal to the mobile station when it has been determined that a collision has not occurred between the access requests; means for allowing the mobile station to start communication with the base station upon receipt of the access approval signal; and means for, upon failure to receive the access approval signal from the base station, returning to the means repeating the transmissions of an access request signal to the base station from the mobile station via another unoccupied reverse link access channel.

An embodiment provides apparatus wherein the mobile stations comprises a timer and the mobile station repeats the access channel request when an access approval signal has not been received within a predetermined time has since performing the access channel request.

An embodiment of the present invention provides a method for connecting mobile stations to a base station in a radio communication system having a plurality of channels. In the method, the base station allocates one of the channels as a

broadcast channel and transmits channel information about the access channels currently occupied to the mobile stations via the broadcast channel. Each of the mobile stations transmits an access request signal to the base station via an access channel currently unoccupied based on the channel information received via the broadcast channel from the base station. Upon receipt of an access approval signal from the base station, the mobile station requesting access accesses the base station via the unoccupied channel.

Advantageously, the present invention reduces the possibility of collision between the access requests, when a plurality of mobile stations request access to a base station in a radio communication system and also reduces the access time required when a mobile station requests access to a base station in a radio communication system.

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

figure 1 is a diagram showing the connection from mobile stations to a base station in a common radio communication system;

figures 2 and 3 are diagrams for explaining conventional access operations in a radio communication system;

figure 4 is a diagram showing a channel configuration according to an embodiment of the present invention;

figure 5 is a flow chart showing an access operation in

radio communication system according to an embodiment of the present invention;

figure 6 is a diagram showing that a base station transmits channel information about the occupied channels to the mobile stations according to an embodiment of the present invention; and

figure 7 is a diagram showing that two mobile stations make access requests through the same unoccupied access channel.

It is to be noted that the present invention is applied to a radio communication system including a single base station and a plurality of the mobile stations, as shown in figure 1. Here, the multiple access channels between the mobile stations and the base station have a structure as shown in figure 4, that is, a forward link (BS  $\rightarrow$  MS) channel FCH#0 is allocated as a broadcast channel and a reverse link (MS  $\rightarrow$  BS) channels RCH#1, RCH#n are allocated as access channels. The base station transmits information about the availability of the access channels, that is, information about whether or not the access channels are currently occupied to all the mobile stations through the broadcast channel FCH#0.

Figure 5 is a flow chart showing an access operation between the base station and the mobile stations according to the present invention. Here, it is assumed that the first mobile station 201 makes an access request to the base station 100.

Referring to figure 5, during the access operation, the

base station 100 continuously transmits information about the access channels currently occupied for the access operation to the first mobile station 201 via the broadcast channel FCH#0. The first mobile station 201 then receives the channel information transmitted from the base station 100 via broadcast channel FCH#0, at step 501. As shown in figure 6, the base station 100 transmits the channel information about the occupied access channels to all other mobile stations 202-204.

The first mobile station 201 analyses the channel information received via the broadcast channel FCH#0 at step 502, and transmits an access request signal to the base station 100 via an access channel, for example access channel RCH#2, which is not currently occupied, at step 503. Then, through steps 504 to 507, it is determined whether a collision has arisen between the access requests made through the access requested channel RCH#2. Specifically, the first mobile station 201 transmits the access request signal to the base station 100 via the unoccupied access channel RCH#2 at the step 503, and waits for an access approval signal from the base station 100 at the steps 504 to 506. The first mobile station 201 drives a first timer T1 provided therein at the step 505. If it is determined at step 506 that the first timer T1 has counted for a first predetermined time, the first mobile station 201 determines at step 507 whether an access approval signal has been received from the base station 100. If the access approval signal has been received, this indicates that collisions had not occurred between the access requests made via the unoccupied

access request channel. If the access approval signal has not been received, this indicates that a collision has occurred between the access requests made via the unoccupied access request channel.

In the case where a collision has not occurred between the access requests, the first mobile station 201 accesses the base station 100 via the unoccupied channel RCH#2 upon receipt of the access approval signal, at step 510.

However, if a collision has occurred between access requests made via the access channel RCH#2 as shown in figure 7, the first mobile station 201 returns to step 501 to repeat the above procedure after the elapse of a second predetermined time T2 at steps 508 and 509. The first mobile station 201 drives a second timer T2 provided therein, at step 508. If it is determined at step 509 that the second timer T2 has timed out, that is, counted for the second predetermined time, the first mobile station 201 returns to the step 501 to repeat the above procedure. The above procedure is repeated until it is determined at step 507 that a collision has not occurred between the access requests (i.e. until an access approval signal has been received from the base station 100) within predetermined times. If it is determined that a collision has not occurred between the access requests, the first mobile station 210 accesses the base station 100 via the unoccupied access channel.

As described above, the mobile station accesses the base

station depending upon the channel information concerning the currently unoccupied channels, received from the base station. As a result, a collision that may occur when the mobile station makes the access request via the access channel currently occupied can be prevented. In addition, the access time can be reduced.

While an exemplary embodiment of this invention has been described in detail, those skilled in the art will recognize that there are many possible modifications and variations which may not be made in the exemplary embodiment while yet retaining many of the novel features and advantages of the invention. Accordingly, the present invention embraces all such alternative modifications and variations as fall within the spirit and scope of the appended claims.

Although the above embodiments have been described in terms of the broadcast channel containing information concerning access channels which are occupied, it will be appreciated that embodiments can equally well be realised in which the broadcast channel transmits information concerning access channels which are unoccupied. In general the broadcast channel contains information relating to the availability of the access channels.



**CLAIMS**

1. A method for connecting a mobile station of a plurality of mobile stations to a base station in a radio communication system having a plurality of forward link and reverse link access channels, the method comprising the steps of:

allocating, at said base station, one of the forward link channels for a broadcast channel and transmitting channel information about the availability of the reverse link access channels to the mobile stations via the forward link broadcast channel;

transmitting an access request signal to the base station from the mobile stations via a reverse link access channel currently that is unoccupied based on the channel information received via the forward link broadcast channel; and

allowing the mobile stations to access the base station via the currently unoccupied channel.

2. A method for connecting a mobile station to base stations in a radio communication system, comprising the steps of:

(a) allocating, at the base station, one of plurality of forward link channels as a broadcast channel and transmitting channel information about the current availability of reverse link access channels to the mobile station via the broadcast channel;

(b) analyzing at the mobile station, the channel information and transmitting an access request signal to said base station via one of the unoccupied reverse link channels;

(c) determining whether a collision has occurred between the access request of the mobile station and an access request of another mobile station on the unoccupied reverse link access channel;

(d) transmitting, from the base station an access approval signal to the mobile station when it has been determined that a collision has not occurred between the access requests;

(e) allowing the mobile station to start communication with the base station upon receipt of the access approval signal; and

(f) upon failure to receive the access approval signal from the base station, returning to step (b) to transmit an access request signal to the base station from the mobile station via another unoccupied reverse link access channel.

3. A method as claimed in claim 2, wherein the mobile stations comprises a timer and the mobile station returns to step (b), when the access approval signal has not been received after a predetermined time has elapsed since performing said step (b).

4. Apparatus for connecting a mobile station of a plurality of mobile stations to a base station in a radio communication system having a plurality of forward link and

reverse link access channels, the apparatus comprising:

means for allocating, at said base station, one of the forward link channels for a broadcast channel and transmitting channel information about the availability of the reverse link access channels to the mobile stations via the forward link broadcast channel;

means for transmitting an access request signal to the base station from the mobile stations via a reverse link access channel currently that is unoccupied based on the channel information received via the forward link broadcast channel; and

means for allowing the mobile stations to access the base station via the currently unoccupied channel.

5. Apparatus for connecting a mobile station to base stations in a radio communication system, the apparatus comprising:

means for allocating, at the base station, one of plurality of forward link channels as a broadcast channel and transmitting channel information about the current availability of reverse link access channels to the mobile station via the broadcast channel;

means for analyzing at the mobile station, the channel information and transmitting an access request signal to said base station via one of the unoccupied reverse link channels;

means for determining whether a collision has occurred between the access request of the mobile station and an access request of another mobile station on the unoccupied reverse link access channel;

means for transmitting, from the base station an access approval signal to the mobile station when it has been determined that a collision has not occurred between the access requests;

means for allowing the mobile station to start communication with the base station upon receipt of the access approval signal; and

means for, upon failure to receive the access approval signal from the base station, returning to the means repeating the transmission of an access request signal to the base station from the mobile station via another unoccupied reverse link access channel.

6. Apparatus as claimed in claim 2, wherein the mobile stations comprises a timer and the mobile station repeats the access channel request when an access approval signal has not been received within a predetermined time has since performing the access channel request.

7. A method for connecting a mobile station to a base station substantially as described herein with reference to and/or as illustrated in the accompanying drawings.

8. Apparatus for connect a mobile station to a base station substantially as described herein with reference to and/or as illustrated in the accompanying drawings.



Application No: GB 9819891.4  
Claims searched: 1 to 8

Examiner: Glyn Hughes  
Date of search: 17 January 1999

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): H4L (LDSU)

Int Cl (Ed.6): H04Q 7/32, 7/38

Other: Online: WPI

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2297013 A (NOKIA) see page 8 lines 16 to 25 and figure 2	1, 2, 4, 5
X	GB 2277849 A (SPECTRONICS) see page 7 line 28 to page 8 line 21	1, 4
X	EP 0734191 A1 (NTT) see abstract	1, 4

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